

1. An apparatus for monitoring an operation of a fluid dispensing gun dispensing a pattern of fluid onto a substrate moving with respect to the dispensing gun, the dispensing gun changing operating states in response to transition signals, and a sensor disposed adjacent the substrate for providing  
5 feedback signals in response to detecting edges of fluid on the substrate, the apparatus comprising:

a diagnostic monitor responsive to the transition signals and the feedback signals for automatically measuring delays between detecting occurrences of the transition signals and detecting corresponding edges of fluid  
10 on the substrate resulting from the transition signals.

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2. The apparatus of claim 1 wherein said diagnostic monitor further comprises a signal correlator for correlating the feedback signals to the transition signals to measure the delays.

5 3. The apparatus of claim 2 wherein said diagnostic monitor further comprises a signal correlator for identifying edges of the transition signals representing changes of state of the dispensing gun and identifying corresponding edges of the fluid resulting from the edges of the transition signals, and thereafter, correlating the corresponding edges of the fluid to the  
10 edges of the transition signals.

4. The apparatus of claim 2 wherein said diagnostic monitor further comprises:

an input signal processor for periodically sampling the transition  
15 signals and storing first representations of edges of the transition signals, the signal processor also sampling the feedback signals and storing second representations of corresponding edges of the fluid resulting from the edges of the transition signals; and

a signal correlator for correlating said second representations of  
20 edges to said first representations of edges to determine delays between edges of the transition signals and the corresponding edges of fluid on the substrate resulting from the edges of the transition signals.

5. The apparatus of claim 4 wherein said diagnostic monitor further  
25 comprises an output processor for presenting said delays to a user.

6. An apparatus for monitoring an operation of a fluid dispensing gun dispensing a pattern of fluid onto a substrate moving with respect to the dispensing gun, the dispensing gun changing operating states in response to transition signals, the apparatus comprising:

5 a sensor disposed adjacent the substrate for providing feedback signals in response to detecting edges of fluid on the substrate; and

a diagnostic monitor responsive to the transition signals and said feedback signals for automatically measuring delays between detecting occurrences of the transition signals and detecting corresponding edges of fluid on the substrate resulting from the transition signals.

7. An apparatus for monitoring an operation of a dispensing gun dispensing a pattern of adhesive onto a substrate moving with respect to the dispensing gun, the apparatus comprising:

15 a pattern controller providing transition signals representing changes of state of operation of the dispensing gun;

a gun driver operatively connected to the fluid dispensing gun and changing operating states of the dispensing gun in response to said transition signals;

20 a sensor disposed adjacent the substrate, said sensor providing feedback signals in response to detecting edges of adhesive on the substrate; and

a diagnostic monitor electrically connected to said sensor and responsive to said transition signals, said diagnostic monitor automatically determining delays between transition signals and corresponding edges of the adhesive on the substrate resulting from said transition signals.

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8. An apparatus for monitoring an operation of a dispensing gun dispensing a pattern of adhesive onto a substrate moving with respect to the dispensing gun, the apparatus comprising:

5 a pattern controller providing first transition signals representing changes of state of operation of the dispensing gun;

a gun driver providing second transition signals to the fluid dispensing gun in response to said first transition signals, said second transition signals causing the dispensing gun to change operating states;

10 a sensor disposed adjacent the substrate, said sensor providing feedback signals in response to detecting edges of adhesive on the substrate; and

15 a diagnostic monitor electrically connected to said sensor and responsive to one of said first and said second transition signals, said diagnostic monitor automatically determining delays between said one of said first and said second transition signals and corresponding edges of the adhesive on the substrate resulting from said one of said first and said second transition signals.

9. An apparatus for monitoring an operation of a dispensing gun dispensing a pattern of adhesive onto a substrate moving with respect to the dispensing gun, the apparatus comprising:

a pattern controller providing gun ON and OFF signals representing  
5 times at which the dispensing gun should open and close, respectively;

a gun driver operatively connected to the dispensing gun and opening and closing the dispensing gun in response to said gun ON and OFF signals, respectively;

a sensor disposed adjacent the substrate, said sensor providing  
10 feedback signals in response to detecting edges of the adhesive on the substrate;

a diagnostic monitor electrically connected to said sensor and responsive to said gun ON and OFF signals, said diagnostic monitor automatically determining delays between said gun ON and OFF signals and  
15 corresponding edges of the adhesive on the substrate resulting from gun ON and OFF signals.

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10. A method of monitoring an operation of a dispensing gun dispensing a pattern of fluid onto a substrate moving with respect to the dispensing gun, the dispensing gun turning ON and OFF in response to transition signals and a sensor providing feedback signals representing detected edges of fluid dispensed onto the substrate by an operation of the fluid dispensing gun, the method comprising measuring delays between occurrences of the transition signals and detecting corresponding edges of the fluid resulting from the transition signals.
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11. The method of claim 10 further comprising:  
detecting occurrences of transition signals commanding the  
dispensing gun to turn ON and OFF;  
turning the dispensing gun ON and OFF in response to the  
5 transition signals; and  
detecting edges of fluid dispensed onto the substrate in response  
to the dispensing gun being turned ON and OFF.

12. The method of claim 10 further comprising providing an output  
10 relating to the delays.

13. The method of claim 10 further comprising:  
providing a signal representing a presence of the substrate in a  
proximity of the dispensing gun; and  
15 sampling the transition signals and the feedback signals on a  
periodic basis;  
storing sampled transition signals and sampled feedback signals;  
and  
correlating the sampled feedback signals to the sampled transition  
20 signals to determine the delays.

14. The method of claim 13 further comprising sampling the transition  
signals and the feedback signals on a periodic basis determined by equal  
increments of time.

15. The method of claim 13 further comprising sampling the transition  
signals and the feedback signals on a periodic basis determined by equal  
increments of relative motion between the substrate and the dispensing gun.

16. The method of claim 13 further comprising identifying edges of the transition signals commanding the dispensing gun to turn ON and OFF.

5 17. The method of claim 16 further comprising identifying leading edges of the transition signals representing commands to turn the dispensing gun ON.

10 18. The method of claim 16 further comprising identifying trailing edges of the transition signals representing commands to turn the dispensing gun OFF.

19. The method of claim 16 further comprising identifying leading and trailing edges of the transition signals representing commands to turn the dispensing gun respectively ON and OFF.

15 20. The method of claim 16 wherein the method further comprises:  
generating first, narrow, fixed-width pulses in response to edges of the sampled transition signals; and  
generating second, narrow, fixed-width pulses in response to an edge of respective ones of the sampled feedback signals.

20 21. The method of claim 20 further comprising correlating the second, fixed-width pulses to the first, fixed-width pulses to produce the delays.



22. A method of monitoring an operation of a dispensing gun dispensing an adhesive pattern onto a substrate moving with respect to the dispensing gun, the method comprising:

5 providing gun ON and OFF signals representing times at which the dispensing gun should open and close, respectively;

opening and closing the dispensing gun in response to the gun ON and OFF signals, respectively;

10 providing feedback signals representing edges of the adhesive dispensed onto the substrate resulting from opening and closing the dispensing gun; and

determining delays between occurrences of the gun ON and OFF signals and corresponding edges of the adhesive resulting from the gun ON and OFF signals.

15 23. The method of claim 22 further comprising providing the gun ON and OFF signals from a pattern controller.

24. The method of claim 22 further comprising providing the gun ON and OFF signals from a gun driver.